

What is claimed is:

1. An actuator driving circuit for use with an actuator that comprises a piezoelectric element which is caused to expand and contract by application of a driving signal, a driving member fixed to one end of said piezoelectric element along an expanding/contracting direction thereof, and a movable member frictionally engaging on said driving member, for moving said driving member and said movable member relative to each other by applying a rectangular wave signal to said piezoelectric element and thereby causing expanding/contracting displacements expanding and contracting at respectively different speeds in said driving member, said driving circuit comprising:

a parallel circuit containing an inductive element connected in parallel to said piezoelectric element; and

a capacitive element, connected in series to said parallel circuit, for removing an DC component of said rectangular wave signal, wherein

said parallel circuit and said capacitive element are provided between said piezoelectric element and a voltage applying circuit for applying said rectangular wave signal to said piezoelectric element.

2. An actuator driving circuit as set forth in

claim 1, wherein said capacitive element has a capacitance value larger than a value of damping capacitance of said piezoelectric element.

3. An actuator driving circuit as set forth in claim 1, wherein the capacitance value of said capacitive element is set so that a ratio of a voltage applied across said piezoelectric element to a voltage applied across said capacitive element becomes larger than 9:1.

4. An actuator driving circuit as set forth in claim 1, wherein said inductive element is set to have an inductance value that produces an antiresonance with a damping capacitance of said piezoelectric element.

5. An actuator driving circuit for use with an actuator that comprises a piezoelectric element which is caused to expand and contract by application of a driving signal, a driving member fixed to one end of said piezoelectric element along an expanding/contracting direction thereof, and a movable member frictionally engaging on said driving member, for moving said driving member and said movable member relative to each other by applying a rectangular wave signal to said piezoelectric element and thereby causing expanding/contracting displacements expanding and contracting at respectively different speeds in said driving member, wherein

a series circuit containing a capacitive

element for removing an DC component of said rectangular wave signal and an inductive element connected in series thereto is connected in parallel to said piezoelectric element in such a manner as to interpose between said piezoelectric element and a voltage applying circuit for applying said rectangular wave signal to said piezoelectric element.

6. An actuator driving circuit as set forth in claim 5, wherein said inductive element is set to have an inductance value that produces an antiresonance with damping capacitance of said piezoelectric element.

7. An actuator driving circuit for use with an actuator that comprises: an element array constructed by connecting a plurality of piezoelectric elements, each expanding and contracting by application of a driving signal, along an expanding/contracting direction thereof; a driving member fixed to one end of said element array along said expanding/contracting direction; and a movable member frictionally engaging on said driving member, for moving said driving member and said movable member relative to each other by applying an AC voltage to each of said piezoelectric elements in said element array and thereby causing expanding/contracting displacements expanding and contracting at respectively different speeds in said driving member,

said driving circuit comprising:

a voltage applying circuit which, by dividing said element array into a plurality of piezoelectric element units each having a piezoelectric element, for applying a first sinusoidal wave signal to the piezoelectric element in a first piezoelectric element unit of the piezoelectric element array, and for applying an n-th sinusoidal wave signal of a frequency n times a frequency of said first sinusoidal wave signal to a piezoelectric element in an n-th piezoelectric element unit of the piezoelectric element array, where n is an integer larger than 1; and

an inductive element connected in parallel to each of said plurality of piezoelectric elements and between said voltage applying circuit and said element array.

8. An actuator driving circuit as set forth in claim 7, wherein said element array is divided into two piezoelectric element units.

9. An actuator driving circuit as set forth in claim 7, wherein said element array having a first piezoelectric element unit and a second piezoelectric element,

a second sinusoidal wave signal applied to a piezoelectric element in the second piezoelectric element

unit is a sinusoidal wave signal whose amplitude is one quarter of a amplitude of said first sinusoidal wave signal applied to a piezoelectric element in the first piezoelectric element unit, and whose phase is coincident with the phase of said first sinusoidal wave signal.

10. An actuator driving circuit as set forth in claim 7, wherein said element array having a first piezoelectric element unit and a second piezoelectric element, and a ratio of a length of the first piezoelectric element unit to a length of the second piezoelectric element unit along said expanding/contracting direction is 4:1.

11. An actuator comprising:

- a piezoelectric element which is caused to expand and contract by application of a driving signal;

- a driving member fixed to one end of said piezoelectric element along an expanding/contracting direction thereof;

- a movable member frictionally engaging on said driving member;

- a voltage applying circuit for applying a rectangular wave signal to said piezoelectric element; and

- a parallel circuit containing an inductive element connected in parallel to said piezoelectric element, and a capacitive element, connected in series to

said parallel circuit, for removing an DC component of said rectangular wave signal, said parallel circuit and said capacitive element being provided between said voltage applying circuit and said piezoelectric element, wherein

said actuator moves said driving member and said movable member relative to each other by applying said rectangular wave signal to said piezoelectric element and thereby causing expanding/contracting displacements expanding and contracting at respectively different speeds in said driving member.

12. An actuator comprising:

a piezoelectric element which is caused to expand and contract by application of a driving signal;

a driving member fixed to one end of said piezoelectric element along an expanding/contracting direction thereof;

a movable member frictionally engaging on said driving member;

a voltage applying circuit for applying a rectangular wave signal to said piezoelectric element; and

a series circuit containing a capacitive element for removing an DC component of said rectangular wave signal and an inductive element connected in series thereto, said series circuit being provided between said voltage applying circuit and said piezoelectric element,

wherein

said actuator moves said driving member and said movable member relative to each other by applying said rectangular wave signal to said piezoelectric element and thereby causing expanding/contracting displacements expanding and contracting at respectively different speeds in said driving member.

13. An actuator comprising:

an element array constructed by connecting a plurality of piezoelectric elements, each expanding and contracting by application of a driving signal, along an expanding/contracting direction thereof;

a driving member fixed to one end of said element array along said expanding/contracting direction thereof;

a movable member frictionally engaging on said driving member;

a voltage applying circuit which, by dividing said element array into a plurality of piezoelectric element units each consisting of one or more piezoelectric elements, applies a first sinusoidal wave signal to each piezoelectric element in a first piezoelectric element unit and applies an n-th sinusoidal wave signal of a frequency n times the frequency of said first sinusoidal wave signal to each piezoelectric element in an n-th piezoelectric element

unit, where n is an integer larger than 1; and

an inductive element connected in parallel to each of said plurality of piezoelectric elements and between said voltage applying circuit and said element array, wherein

said actuator moves said driving member and said movable member relative to each other by applying an AC voltage to each of said piezoelectric elements in said element array and thereby causing expanding/contracting displacements expanding and contracting at respectively different speeds in said driving member.